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An Old-Growth Definition for Sand Pine Forests

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Introduction

Sand pine scrub, Society of American Foresters cover type 69 (Eyre 1980), grows on deep, droughty, infertile sands of marine and aeolian origin. Water and wind formed these features as sea levels fluctuated during past glacial and interglacial periods (Kurz 1942, Laessle 1958, Brooks 1972). Because of washing and sorting during transport and deposition, soil parent material was nearly pure quartz sand (Laessle 1958). This produced soils that are almost exclusively entisols and mostly Quartzipsamments (Myers 1990), typified by the Astatula, Lakeland, Paola, and St. Lucie soil series.

The Ocala variety (*Pinus clausa* var. *clausa* D.B. Ward) of sand pine is native to the central ridge of Florida and a strip of old dunes stretching from St. John's County south to the northern portion of Dade County on the east coast and from near Cedar Key south to Naples on the west coast (Small 1921, Harper 1927, Myers 1990). Choctawhatchee sand pine (*P. clausa* var. *immuginata* D.B. Ward) is the dominant tree in scrubs along the Gulf Coast (including off-shore islands) of northwest Florida from the Apalachicola River westward into Alabama. The largest concentration of sand pine is the interior scrub, which occupies about 250,000 acres (ac) [101,250 hectares (ha)] on the Ocala National Forest (Brendemuehl 1990).

Sand pine is native to areas that have hot, humid summers, somewhat dry winters, and a long growing season (269 to 312 days). Precipitation is abundant, 53.0 to 60.0 inches per year [1345 to 1525 millimeters (mm) per year]; July is the wettest and May the driest month. Because of the low moisture-holding capacity of the soils, drought conditions can exist within 2 weeks of a heavy rainfall. Surface temperatures of exposed soils can also be extreme, reaching 140 °F (60 °C) on summer days (Burns and Hebb 1972).

Ocala sand pine forests have an overstory of even-aged sand pine with twisted and leaning trunks growing over an understory of evergreen shrubs (Myers 1990). Typical understory species include myrtle oak (*Quercus myrtifolia* Willd.), sand live oak [*Q. virginiana* var. *geminata* (Small) Sarg.], Chapman oak (*Q. chapmanii* Sarg.), turkey oak (*Q. laevis* Walt.), rusty lyonia [*Lyonia ferruginea* (Walt.) Nutt.], rosemary (*Ceratiola ericoides* Michx.), scrub palmetto (*Sabal etonia* Swingle ex Nash), and saw-palmetto [*Serenoa repens* (Bartr.) Small]. Because of dry soils and competition from the sand pine overstory and understory shrubs, herbs and grasses are very sparse in mature scrub habitats. Typical species include beak-rush (*Rhynchospora megalocarpa* Vahl), milk-peas (*Galactia* spp.), and bluestem (*Andropogon* spp.). Lichens (*Cladonia* spp.) form extensive patches on the forest floor.

Because of its sparse ground cover and compacted litter layer, Ocala sand pine scrub seldom burns. Periodically (every 10 to 100 years), usually during the spring drought, high winds and extreme conditions result in high-intensity fires. These fires burn off the understory and kill the sand pine overstory (Myers 1990). These fires also open the many serotinous cones contained in the crowns of the sand pine, releasing the seed for establishment of the next stand. Choctawhatchee sand pine trees produce cones that open at maturity, so catastrophic fires are not required for regeneration. Overstory trees are more likely replaced as a result of blow-down from periodic tropical storms.

These sand pine scrub communities are unique habitats with a mix of species that occur nowhere else (Christman and Judd 1990). Although most of the endemic species thrive in the open scrub when sand pine trees are just seedlings, the old-growth stage is still an important part of the ecosystem.

Old-growth sand pine [*P. clausa* (Chapm. ex Engelm.) Vasey ex Sarg.] stands were inventoried and a set of attributes developed to characterize what constitutes old growth for this forest ecosystem. Preliminary sampling indicated that there was a change in stand structure around age 50 years for Ocala sand pine. Based on this information, three stands of Ocala sand pine were randomly chosen from all the stands on the Ocala National Forest with an average age of 50 years or more. Within each stand, three circular plots 0.25 ac (0.1 ha) were established. The species, diameter, and crown class were recorded for all trees 4 inches [10 centimeters (cm)] or larger within these plots.

Table 1 (English units)—Standardized table of old-growth attributes for Ocala sand pine forests [a] [b]

Quantifiable attribute	Value	
	Range	Mean
Stand density (no./acre)		
—trees ≥4 in. d.b.h.		
Ocala sand pine	65 - 121	79.0
Dominants	38 - 53	41.0
Codominants	8 - 51	21.0
Intermediates	6 - 24	11.0
Suppressed	4 - 9	6.0
Mid-story oaks	4 - 40	25.0
Stand diameter (in)		
Ocala sand pine	6.2- 8.6	7.5
Dominants	8.6- 12.5	10.8
Codominants	6.7- 8.3	7.5
Intermediates	5.8- 6.3	6.0
Suppressed	4.9- 5.0	4.9
Mid-story oaks	5.9- 7.9	6.9
Stand basal area (ft^2/acre)		
—trees ≥4 in. d.b.h.		
Ocala sand pine	36.6- 39.2	37.5
Mid-story oaks	.4- 7.0	3.5
Age of largest trees (yrs)		
Ocala sand pine	45 - 70	55.0
Diameter of largest trees (in)		
Ocala sand pine	10 - 17	14.0
Height of largest trees (ft)		
Ocala sand pine	50 - 82	72.0
Standing snags (no./acre)		
—snags ≥4 in. d.b.h.	5 - 30	19.0
Downed logs (% cover)	.5- 5.0	2.4
Number of canopy layers	--	3.0
Canopy gaps (% cover)	5 - 75	27.0
Other features		
Stumps (no./acre)	--	3.0

[a] Number of stands is three in all attributes.
[b] The reference for all attributes is Kenneth W. Outcalt.

Table 1 (metric units)—Standardized table of old-growth attributes for Ocala sand pine forests [a] [b]

Quantifiable attribute	Value	
	Range	Mean
Stand density (no./ha)		
—trees ≥10 cm d.b.h.		
Ocala sand pine	160 - 300	194.0
Dominants	93 - 130	101.0
Codominants	20 - 125	51.0
Intermediates	15 - 60	27.0
Suppressed	10 - 23	15.0
Mid-story oaks	10 - 100	62.0
Stand diameter (cm)		
Ocala sand pine	15.7- 21.8	19.1
Dominants	21.9- 31.8	27.4
Codominants	*17.1- 21.0*	*19.0*
Intermediates	14.6- 15.9	15.3
Suppressed	12.5- 12.6	12.5
Mid-story oaks	15.0- 20.0	17.5
Stand basal area (m^2/ha)		
—trees ≥10 cm d.b.h.		
Ocala sand pine	8.4- 9.0	8.6
Mid-story oaks	.1- 1.6	.8
Age of largest trees (yrs)		
Ocala sand pine	45 - 70	55.0
Diameter of largest trees (cm)		
Ocala sand pine	26 - 43	35.0
Height of largest trees (m)		
Ocala sand pine	15 - 25	22.0
Standing snags (no./ha)		
—snags≥10 cm d.b.h.	13 - 73	47.0
Downed logs (% cover)	.5- 5.0	2.4
Number of canopy layers	--	3.0
Canopy gaps (% cover)	5 - 75	27.0
Other features		
Stumps (no./ha)	--	*8.0*

[a] Number of stands is three in all attributes.
[b] The reference for all attributes is Kenneth W. Outcalt.

Old-growth conditions will develop as stands progress beyond age 50 years; numerous examples exist on the Ocala National Forest. A good example of old-growth coastal scrub is found in the Southwest Florida Water Management District and occupies a portion of the Starkey Tract in southwestern Pasco County.

Land managers can produce old-growth by carrying some stands past the normal rotation age of 35 to 40 years. Old growth is a short-lived state, however, as stands rapidly lose their sand pine beyond 70 years (Richardson 1977). Without some disturbance from fire or harvesting, stands will eventually form xeric hammocks dominated by oaks (Laessle 1958, Veno 1976, Myers 1985). For this reason, fire needs to be allowed to occur naturally or should be introduced artificially in designated Ocala sand pine wilderness areas. This will open the area to the many endemic plants and animals that prefer the young scrub and will foster natural regeneration and establishment of even-aged sand pine stands that will later again develop into old-growth stands.

Choctawhatchee Sand Pine

The overstory of old-growth Choctawhatchee sand pine stands is almost exclusively sand pine with an occasional longleaf pine (*P. palustris* Mill.) or large sand live oak. The old-growth stands sampled were relatively well stocked, with groups of overstory sand pine and fair-sized oaks in the intervening canopy gaps (table 4). Because Choctawhatchee sand pine sheds most of its seed when cones mature, regeneration is a continuous process. This results in a large number of trees in the intermediate and suppressed crown classes (46 percent) and fewer dominants (35 percent).

Average tree diameter was 7.9 inches (20.1 cm), while dominant trees averaged more than 12.0 inches (30.0 cm) in diameter. The largest trees in the old-growth stands had a mean diameter of more than 15.0 inches (39.0 cm), were 70.0 feet (22.0 m) tall and 80 years old. Good stocking and tree size gave a basal area of 70.0 square feet per ac (16.0 square meters per ha). Snags were evident but not prevalent. Canopy gaps were numerous, occupying 25 percent of the area. Most of these gaps were the result of blow-down from a major hurricane that occurred about 20 years ago. Downed logs occurred but were not common.

Mid-story oaks were a prominent feature of the old-growth stands. More than one-third of all trees larger than 4.0 inches (10.0 cm) diameter at breast height were oaks. The average diameter of the oaks was 1.6 inches (4.0 cm) smaller than that of the sand pine, but they made up 20 percent of the total stand basal area. Sand live oak was predominant, making up 84 percent of the mid-story layer. Most of the trees in this layer were 20.0 to 35.0 feet (6.1 to 10.7 m) tall with an occasional individual 40.0 to 50.0 feet (12.2 to 15.2 m) high reaching into the lower portion of the overstory canopy. Beneath the mid-story was a shrub layer from 10.0 to 20.0 feet (3.0 to 6.1 m) tall, dominated by sand pine regeneration and oaks with lesser numbers of tree blueberry (*Vaccinium* spp.) (table 5). Ongoing work at Eglin Air Force Base indicates that the composition of these shrub layers can be quite variable.[2] The sparse understory layer was mostly woody species and a few herbs growing between patches of lichens (table 6). The thin forest floor had a mean thickness of 1.7 inches (4.3 cm).

There were no indicator species specific to old-growth Choctawhatchee sand pine stands. The best identifiers of old-growth status are the size and age of the sand pine overstory; the presence of numerous large, mid-story oaks; and the abundant canopy gaps. The amount of downed woody material is a poor indicator because it varies greatly depending on the length of time since the last major hurricane.

The ecology and dynamics of the Choctawhatchee sand pine community have been studied less than those of the Ocala scrubs. The importance and natural abundance of old-growth stands is not specifically known. However, since some old growth was part of the natural landscape, it is wise to allow for its continued existence until we better understand its function and importance to the ecosystem. To do this, land managers can produce old growth by allowing some stands to reach 70 to 100 years of age. A good example of these old-growth conditions occurs in stands at Fred Gannon State Park near Niceville, FL. Other old-growth Choctawhatchee sand pine stands occupy areas on nearby Eglin Air Force Base.

[2] Personal communication. 1996. Stephen Seiber, Acting Chief, Natural Resources Division, Eglin Air Force Base, AFDTC/EMNF, 107 Highway 85N, Niceville, FL 32542.

Table 5—Density of species in tall shrub layer of old-growth Choctawhatchee sand pine stands

Species	Diameter class					
	0.8-2.39 in	2.4-3.14 in	3.5-3.9 in	2.0-5.9 cm	6.0-7.9 cm	8.0-9.9 cm
	Number per acre			*Number per hectare*		
Pinus clausa var. *immuginata*	214	26	9	530	65	22
Quercus virginiana var. *geminata*	36	18	9	90	44	22
Vaccinium arboreum	40	13	9	100	33	22
Q. laevis	44	9	--	110	22	--
Q. laurifolia	26	4	--	65	11	--
Q. myrtifolia	36	--	--	90	--	--

Table 6—Abundance of major understory species found in old-growth Choctawhatchee sand pine stands

Species	English		Metric	
	>3.3 ft	≤3.3 ft	>1 m	≤1 m
	No./yd²		*No./m²*	
Shrubs				
Ilex vomitoria	0.10	3.6	0.10	3.3
Quercus laurifolia	.03	2.2	.03	2.0
Smilax spp.	--	2.2	--	2.0
Pinus clausa var. *immuginata*	.30	2.0	.30	1.8
Q. myrtifolia	--	1.4	--	1.3
Q. virginiana var. *geminata*	.03	1.3	.03	1.2
Licania michauxii	--	.7	--	.6
Q. laevis	--	.1	--	.1
Herbs (% cover)				
Rhychospora spp.		3.0		3.0
Galactia volubilis		2.0		2.0
Panic spp.		2.0		2.0
Lichens (% cover)				
Cladonia spp.		30.0		30.0

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Sand pine scrub, dominated by the Ocala variety, is native to the deep, dry, sandy deposits of central Florida. Choctawhatchee sand pine occurs on sandy sites along the coast of the Florida panhandle and adjoining counties in Alabama. Scrub consists of an overstory of sand pine and an understory of woody species dominated by oaks. Selected stands of old sand pine were sampled on the Ocala National Forest and near Niceville, FL, to determine the characteristics of old growth. Old-growth Ocala sand pine stands had an overstory of sand pine with some trees at least 14.0 inches (35.6 centimeters) in diameter and more than 55 years old. Canopy gaps were usually prevalent, often covering 25 percent or more of the area. Oaks, predominately sand live oaks, formed a conspicuous mid-story layer within these gaps. Old-growth Choctawhatchee sand pine stands were similar but generally had bigger and older trees than Ocala stands. Good examples of Ocala old growth exist on the Ocala National Forest. Stands of old-growth Choctawhatchee sand pine grow near Niceville, FL, on Eglin Air Force Base and nearby Fred Gannon State Park.

Keywords: Florida, oak, old growth, sand pine, scrub, understory.